

Braziel Creek Phase 2 Restoration Project

Preliminary Design Report and Drawings



Prepared By:

Big Blackfoot Chapter of Trout Unlimited
PO Box 1
Ovando, Montana 59854-0001



This page left intentionally blank

Table of Contents

1	Introduction	1
1.1	Project Background	1
1.2	Document Purpose	1
2	Existing Baseline Conditions	3
2.1	Channel Morphology	3
2.2	Fish Habitat	5
2.3	Riparian	5
3	Restoration Approach	5
3.1	Project Goals	5
3.2	Design Dimensions	6
3.3	Restoration Treatments	7
3.3.1	Sod and Brush Willow Fascines	7
3.3.2	Channel Construction	8
3.3.3	Small Wood Habitat Structures	9
3.3.4	Riparian Exclosure and Future Land Use Management	10
3.4	Preliminary Design	10
4	Conclusion	10

Attachment A: Preliminary Design Drawings

1 Introduction

1.1 Project Background

Braziel Creek is a third-order tributary to Nevada Creek located in Powell County southeast of Helmville, Montana (Figure 1-1). Draining a relative small watershed area, Braziel Creek flows approximately four miles through Bureau of Land Management and private lands before entering Nevada Creek approximately two miles downstream of Nevada Creek Reservoir. Braziel Creek currently supports populations of westslope cutthroat trout and sculpin, and has been identified by the Montana Department of Environmental Quality as impaired due to siltation, habitat alterations, and nutrient loading.

In 2010, the Big Blackfoot Chapter of Trout Unlimited (BBCTU) and project partners initiated a project on a reach of Braziel Creek impacted by channelization, ice gorging, fish passage barriers, and grazing. These impairments contributed to excessive sedimentation and degradation of aquatic habitat and water quality. The goal of the restoration project was to enhance, protect and expand populations of westslope cutthroat trout within the context of a restoration project on private land. Project specifics involved restoring 1,500 feet of channel, installing a fish screen, and upgrading an existing diversion and stream crossing to accommodate fish passage. A grazing management plan was also implemented. Fish population monitoring in 2011 and 2012 found a substantial increase in post-restoration westslope cutthroat trout abundance (10 fish/100 ft pre-project compared with 35 fish/100 ft post-project-FWP unpublished data).

The recent channel work on Braziel Creek resulted in a new B-type stream type that consolidated flows, reconnected the floodplain, and improved the sediment transport characteristics of the channel. In 2011, floods caused channel erosion and aggradation downstream of the Phase 1 restoration project on the Jay Stitt property. Fish habitat quality was degraded, and fish passage was compromised due to sediment accumulation and distributed flow paths that result in habitat fragmentation. BBCTU and project stakeholders are in the preliminary stages of developing restoration design plans for Phase 2, which would include extending restoration work downstream on the Jay Stitt property and a portion of the Phase 1 project reach.

1.2 Document Purpose

This report describes a preliminary restoration plan for Phase 2 of the Braziel Creek Restoration Project. This document is organized in three sections. Section 1 (this section) provides general background information on previous phases of restoration. Section 2 provides a narrative baseline condition description of existing conditions and limiting factors. Section 3 describes the project goals and the proposed restoration strategies and techniques. Attachment A includes the preliminary design drawings.

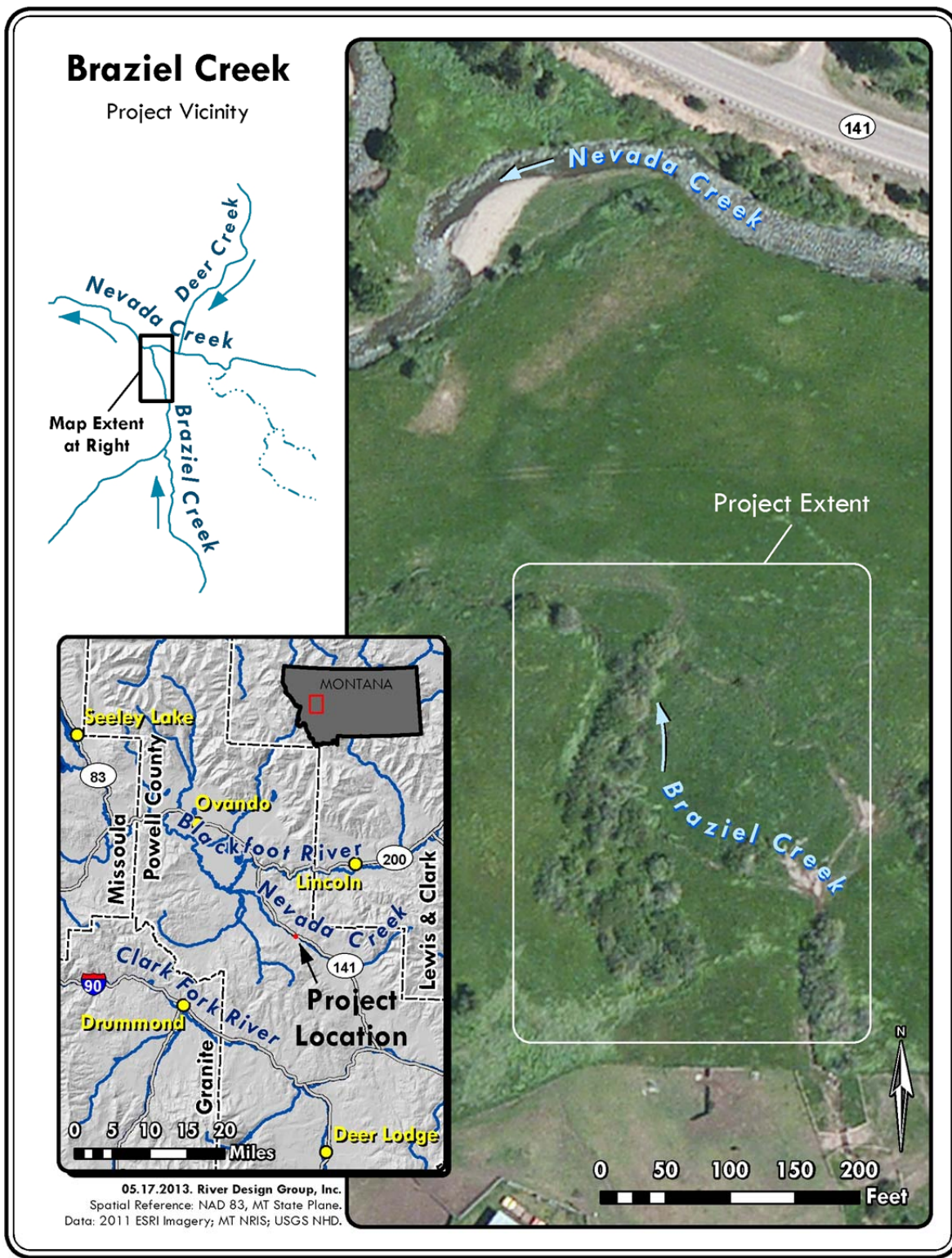


Figure 1-1. Vicinity map of the Braziel Creek Phase 2 restoration project.

2 Existing Baseline Conditions

This section describes the existing baseline conditions in the project area. As described in Section 1, Brazier Creek has been impacted by channelization, ice gorging, fish passage barriers, and grazing. These impairments have resulted in sedimentation, channel instability, bank erosion, and habitat fragmentation. These limiting factors will be addressed through implementation of the restoration plan described in Section 3 of this design report.

2.1 Channel Morphology

Figure 2-1 provides photo documentation of the existing channel and streambank conditions in the project area. As shown, the existing channel has incised and is disconnected from the adjacent floodplain. Streambank erosion rates are high due to loss of vegetation structure, and high bank height ratios are causing geotechnical failure of the overlying streambank sediments. If left untreated, the channel will continue to incise and widen.



Figure 2-1. Typical channel and streambank conditions in the project area.

Table 2-1 summarize existing cross-section dimensions for riffle and pool cross-sections in the project area. As shown, riffle area ranges from 4.9 ft² to 34.7 ft². Higher values are associated with over-widened and entrenched sections of the project area that are trending towards severe incision and entrenchment. Riffle widths range from 4.1 feet in highly entrenched sections to 20.7 feet in areas of aggradation. Pool widths range from 5.8 feet to 11.0 feet with an average cross-sectional area of 11.1 ft². Maximum pool depths range from 1.8 feet to 2.8 feet.

Riffle particle size distributions range from silty/clay to cobble, as shown in Table 2-2. Approximately 81% of the sampled bed material was comprised of gravel; 16% cobble, and 3% sand, silt and clay.

Table 2-1. Cross-section dimensions for riffle (n=7) and pool (n=2) cross-sections in the Brazier Creek project reach.

Dimensions				Dimensionless Ratios ¹			
Metric	Min	Mean	Max	Metric	Min	Mean	Max
Floodprone Width (ft)	22.0	66.7	100	Wfpa / Wbkf	2.53	7.68	11.51
Riffle Area (ft ²)	4.9	12.0	34.7	Riffle Area / Abkf	0.41	1.00	2.89
Max Riffle Depth (ft)	1.1	1.9	2.4	Max Riffle Depth / Dbkf	0.86	1.40	1.80
Mean Riffle Depth (ft)	0.8	1.3	2.0	Mean Riffle Depth / Dbkf	0.62	1.00	1.53
Riffle Width (ft)	4.1	8.7	20.7	Riffle Width / Wbkf	0.47	1.00	2.38
Entrenchment Ratio	3.1	9.8	24.4	Entrenchment Ratio/ER	0.32	1.00	2.48
Width/Depth Ratio	2.9	7.1	12.3	Width/Depth / W/D	0.41	1.00	1.74
Pool Area (ft ²)	8.9	11.1	13.3	Pool Area / Abkf	0.74	0.92	1.11
Max Pool Depth (ft)	1.8	2.3	2.8	Max Pool Depth / Dbkf	1.35	1.71	2.08
Mean Pool Depth (ft)	0.8	1.6	2.3	Mean Pool Depth / Dbkf	0.61	1.17	1.72
Pool Width (ft)	5.8	8.4	11.0	Pool Width / Wbkf	0.67	0.97	1.27

¹ Abkf=12.0 ft², Wbkf=8.7ft, W/D=7.1, ER= 9.8, Dbkf=1.3ft.

Table 2-2. Particle size distribution at cross-section 3: riffle.

	mm	Size Class	Percent of Total
D16	17	Silt/Clay	2.0
D35	26	Sand	1.0
D50	36	Gravel	81.0
D84	64	Cobble	16.0
D95	88	Boulder	0.0
D100	180	Bedrock	0.0

2.2 Fish Habitat

Fish habitat in the project area is generally limited due to the loss of pool habitats, channel incision, bank erosion, and habitat simplification. The downstream 200 feet of channel has been manipulated and is currently aligned cross-valley resulting in sediment deposition and braiding. The channel is undefined in the lower reach and habitat is fragmented during low flow periods. The design will re-establish more stable channel and floodplain conditions that will restore fish passage by increasing the frequency of pools, creating a defined channel with a well-connected and vegetated floodplain surface, and creating a more complex distribution of aquatic habitat features including riffles, runs, pools and glides.

2.3 Riparian

As shown in Figure 2-1, streambank and floodplain woody vegetation is lacking in the project area and has contributed to bank instability, erosion, and sediment delivery to Braziel Creek. High bank height ratios, lack of vegetation rooting structure, and loss of bank roughness characterize riparian areas due to the loss of historical willow complexes that are typical of other riparian areas in the Braziel Creek watershed. The lower portion of the project is characterized by mature willow and carex (i.e. sedge) community types that result in a more complex floodplain environment. The desired future condition is a well-vegetated riparian corridor that supports a mosaic of vegetation cover types including woody vegetation and sedges.

3 Restoration Approach

3.1 Project Goals

The goal of the Braziel Creek Phase 2 Restoration Project is to restore appropriate channel and floodplain morphologies that will result in a self-maintaining stream capable of conveying the sediment and flows produced by the watershed, while providing optimal aquatic habitat conditions for westslope cutthroat trout and other aquatic species. Specifically, the following project objectives have been developed:

- Re-establish a self-maintaining, natural channel with the appropriate stream type for the valley;
- Restore the proper channel morphology, plan form, cross-sectional, and longitudinal profile dimensions to improve fish habitat, sediment transport, and water quality;
- Restore vegetation in order to recover riparian function and habitat forming processes; and
- Incorporate a grazing management, including a grazing enclosure and hardened crossing, to protect planted vegetation within the riparian buffer and along streambanks.

3.2 Design Dimensions

Design dimensions were developed based on hydraulic analyses completed for several reference cross-sections located in the Phase 1 project area. Table 3-1 summarizes the results of the bankfull hydraulic analyses, and the average results as computed using four methods.

Table 3-1. Estimated bankfull discharge (cfs) for riffle cross-sections in the Brazier Creek reference reach.

XS ID	Area (ft ²)	Bankfull Slope (ft/ft)	Manning's Coefficient	Relative Roughness	Darcy-Weisbach	U/U*	Average Discharge
XS 2	5.7	0.0248	25.7	23.8	25.0	24.2	24.7
XS 3	4.9	0.0248	20.3	18.7	19.5	18.9	19.4

Preliminary channel design dimensions are summarized in Table 3-2. Proposed channel dimensions are included on Sheet XS-1 in Attachment A.

Table 3-2. Preliminary channel design dimensions for the Brazier Creek Phase 2 Restoration Project (feet).

Stream Type (Rosgen 1996)	B3 (Reach 1)	C3/4 (Reach 2)
Bankfull Discharge (cfs)	20	20
Bankfull Riffle Width	7.1-7.6 (7.4)	8.8-9.5 (10.0)
Floodprone Width	>15	>20
Mean Riffle Depth	0.7	1.1
Maximum Pool Depth	2.9	4.2
Meander Length	74-132 (103)	95-170 (133)
Radius of Curvature	22-33 (28)	29-43 (36)
Belt Width	29-58 (44)	38-76 (57)
Average Slope (ft/ft)	0.035	0.005

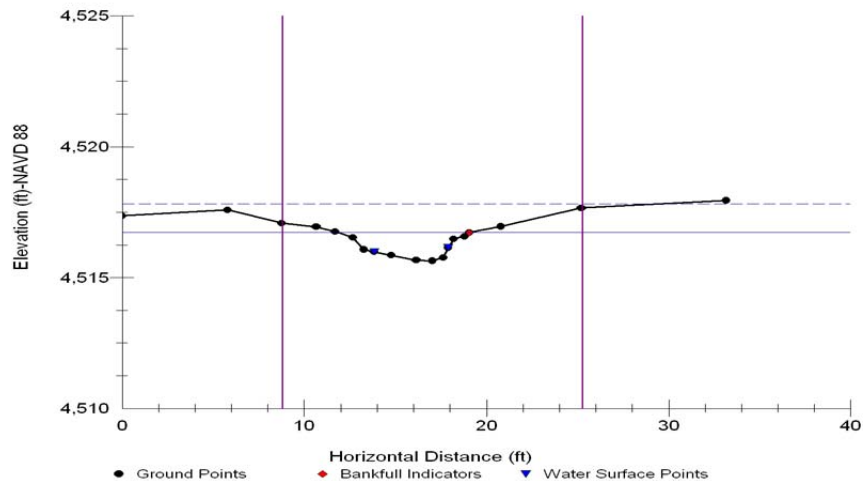


Figure 3-1. Reference riffle cross-section in the Phase 1 project area.

3.3 Restoration Treatments

This section describes the proposed restoration treatments. In general, all structures will be composed of native materials including alluvium, coarse wood, willow cuttings, clump willow transplants, and wetland sods. The treatments are intended to maintain channel and floodplain stability within a natural range of variability in the short-term until the structures decompose and mature vegetation provides long-term stability to the project.

3.3.1 Sod and Brush Willow Fascines

The sod and brush willow fascine is a bank restoration structure that incorporates layers of coarse woody debris (slash, small diameter woody material), willow layering, and wetland sod mats. The intent of the structure is to create stable land-water interface conditions that support development of desired vegetation community types. Clump transplants are integrated with the structure to create rooting structure, floodplain roughness, and overhead cover and shade to the channel. This structure promotes the rapid development of woody vegetation on streambanks. The structure also provides microsites to support natural recruitment of early successional species of desired vegetation community types. The structure also provides bank margin roughness to minimize erosion.

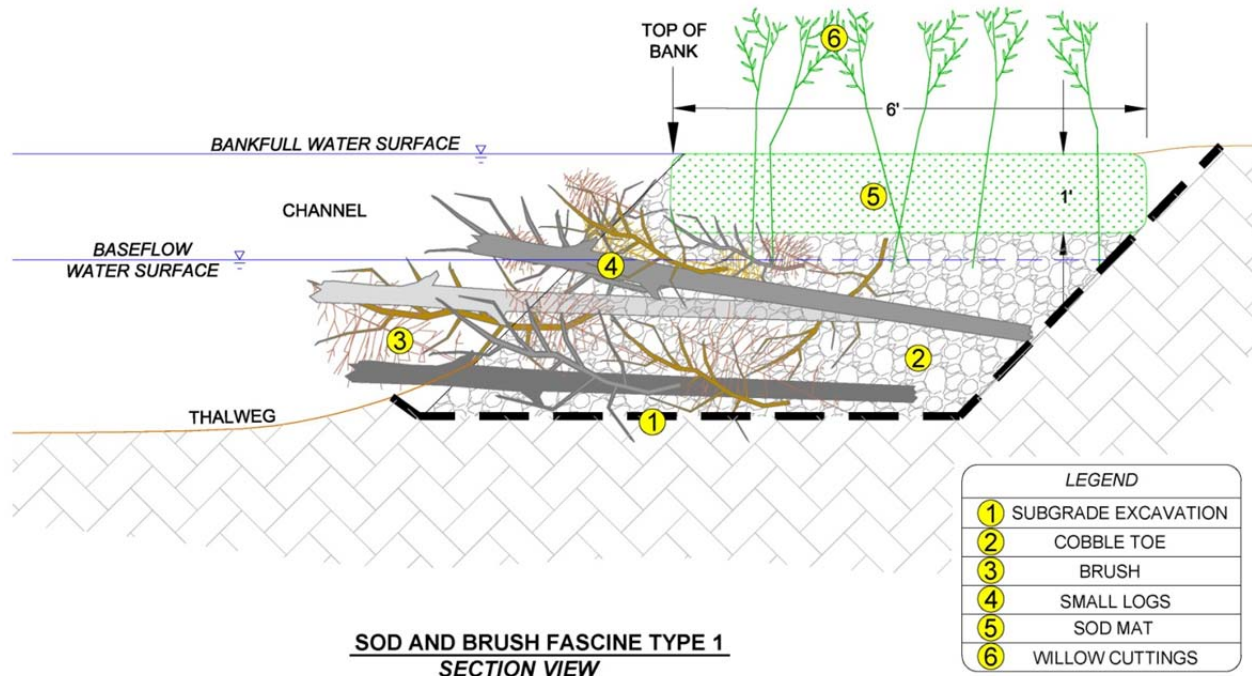


Figure 3-2. Typical drawing of a sod and brush willow fascine bank treatment.

3.3.2 Channel Construction

Restoration will focus on reconstructing approximately 540 feet of channel in Reach 1 and Reach 2. In Reach 1, a slightly meandering, moderately entrenched, riffle-pool B3 stream type will be reconstructed. In Reach 2, the channel will transition from a B3 stream type to an alternating riffle-pool, slightly entrenched C3/C4 stream type. Due to the steep energy gradient of the channel from Station 0+00 to Station 3+40, bed material (native alluvium) will be incorporated to provide stability and maintain floodplain connection. In addition, channel spanning log habitat structures will be built with wood and alluvium. Step-pools will function to dissipate stream energy, provide resting areas for westslope cutthroat trout, and provide channel grade control. The channel will be built to the dimensions summarized in Table 3-2 above. Example channel spanning log habitat structures are shown in Figure 3-3.



Figure 3-3. Example channel spanning log habitat structures built on Pearson Creek (left) and Ashby Creek (right).

3.3.3 Small Wood Habitat Structures

Small wood habitat structures will be incorporated in meander bends associated with pool habitat units. The intent of the small wood structure is to dissipate stream energy and protect streambanks from erosion until deep rooted riparian vegetation is established. Small wood habitat structures also provide cover and complexity for westslope cutthroat trout and other aquatic organisms.

Small woody debris structures are integrated with whole clump willow transplants and willow fascines to encourage woody vegetation establishment. Example photos are included in Figure 3-4.



Figure 3-4. Example constructed small wood habitat structures integrated with willow fascines.

3.3.4 Riparian Enclosure and Future Land Use Management

Jay Stitt, the property owner, has agreed to develop a land use management plan that protects the restoration work from active livestock grazing and agricultural land uses. A riparian enclosure will be installed along the entire length of channel. The approximate location of the fencing enclosure is noted on Sheet PP-1 in Appendix A. The final fencing enclosure will be designed to accommodate the full width of the channel migration zone and floodprone area. A hardened livestock crossing or watering gap will be incorporated in the upper portion of the reach to provide managed access to the creek.

3.4 Preliminary Design

A preliminary design has been prepared to support this grant application. Preliminary drawings are included in Appendix A. The following drawings are included:

- Sheet TL-1: Title Sheet, provides the legal description of the project area, general project background information, and description of the project intent;
- Sheet PP-1: Design Plan and Profile, including the existing and design channel alignments and longitudinal profiles;
- Sheet TC-1: Typical Cross-Section Dimensions, provides riffle and pool typical design cross-sections for Reach 1 and Reach 2;
- Sheet DT-1: Structure Layout, shows the locations of the restoration treatments and structures;
- Sheet DT-1: Structure Layout, shows the locations of restoration treatment and structures along the proposed design alignment;
- Sheet DT-2: Sod Mat Brush Structure, typical drawing;
- Sheet DT-3: Small Wood Habitat Structure, typical drawing; and
- Sheet DT-4: Channel Spanning Log Habitat Structure, typical drawing.

4 Conclusion

This report describes a conceptual restoration plan for the Brazier Creek Phase 2 Restoration Project near Helmville, Montana. The project area has been impacted by historical livestock and agricultural land uses. BBCTU anticipates continuing previous restoration work completed in 2010 to address aquatic habitat and water quality limiting factors. The restoration techniques incorporate native materials to restore channel and floodplain function. A grazing

management plan will be developed and a permanent enclosure will be installed to protect the project area from adjacent land use activities. Attachment A to this report includes a preliminary plan set that further describes the restoration plan, goals and objectives.

BRAZIEL CREEK PHASE 2 RESTORATION ATTACHMENT A PRELIMINARY DESIGN DRAWINGS

PROJECT SPONSOR



Big Blackfoot Chapter of Trout Unlimited
P.O. Box 1
Ovando, Montana 59854-0001

PROJECT DESCRIPTION

BRAZIEL CREEK IS A THIRD-ORDER TRIBUTARY TO NEVADA CREEK LOCATED IN POWELL COUNTY SOUTHEAST OF HELMVILLE, MONTANA (FIGURE 1-1). DRAINING A RELATIVE SMALL WATERSHED AREA, BRAZIEL CREEK FLOWS APPROXIMATELY FOUR MILES THROUGH BUREAU OF LAND MANAGEMENT AND PRIVATE LANDS BEFORE ENTERING NEVADA CREEK APPROXIMATELY TWO MILES DOWNSTREAM OF NEVADA CREEK RESERVOIR. BRAZIEL CREEK CURRENTLY SUPPORTS POPULATIONS OF WESTSLOPE CUTTHROAT TROUT AND SCULPIN, AND HAS BEEN IDENTIFIED BY THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY AS IMPAIRED DUE TO SILTATION, HABITAT ALTERATIONS, AND NUTRIENT LOADING.

BBCU AND PROJECT STAKEHOLDERS ARE IN THE PRELIMINARY STAGES OF DEVELOPING RESTORATION DESIGN PLANS FOR PHASE 2. THE PROJECT INCLUDES CONTINUING RESTORATION APPROXIMATELY 490 FEET DOWNSTREAM OF THE PHASE 1 PROJECT AREA TO ADDRESS LIMITING FACTORS INCLUDING CHANNEL INSTABILITY AND HABITAT FRAGMENTATION. THIS PRELIMINARY SET OF DRAWINGS REPRESENTS A 50% DESIGN DELIVERABLE, AND DESCRIBES THE GENERAL APPROACH TO RESTORATION, INCLUDING THE PROPOSED CHANNEL ALIGNMENT, CROSS-SECTION DIMENSIONS, AND TYPICAL STRUCTURE LAYOUT AND RESTORATION TECHNIQUES. FOLLOWING INPUT FROM PROJECT STAKEHOLDERS, THE DESIGN WILL BE DEVELOPED TO A 100% DESIGN LEVEL EQUIVALENT.

BENCHMARK

SURVEY CONTROL WAS ESTABLISHED UNDER THE RESPONSIBLE CHARGE OF ANDREW BELSKI, PLS 14731.

THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:

HORIZONTAL PROJECTION: US STATE PLANE MT83
HORIZONTAL DATUM: NAD83
HORIZONTAL UNITS: US SURVEY FEET
VERTICAL DATUM: NAVD88 (GEOID 12A)

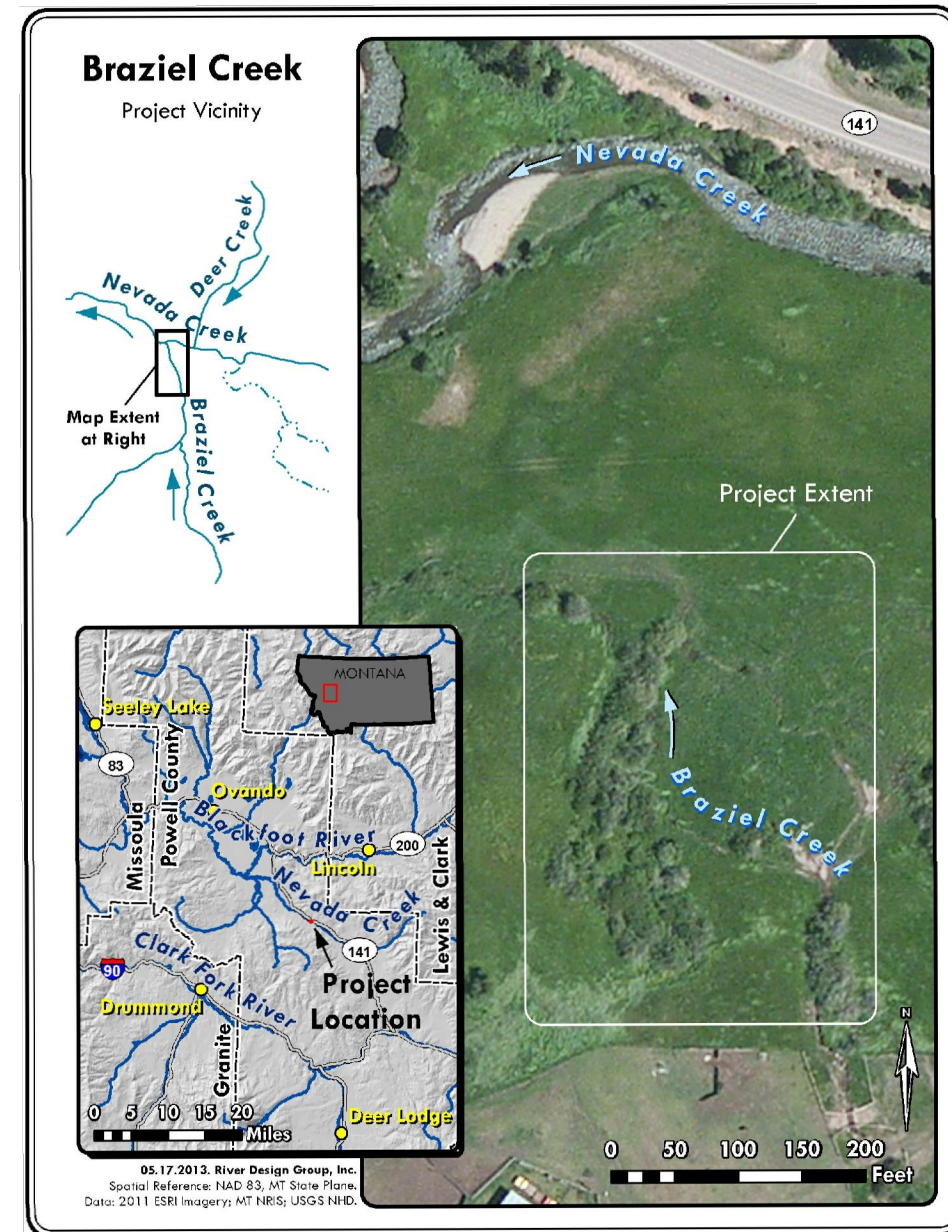
GENERAL NOTES

1. DUE TO THE INHERENT VARIABILITY AND DYNAMIC NATURE OF RIVERS, IT IS NECESSARY TO REVIEW CURRENT CONDITIONS PRIOR TO IMPLEMENTATION OF THE DESIGN DRAWINGS TO ENSURE SITE CONDITIONS MATCH CONDITIONS DEPICTED IN DRAWINGS.
2. RIVER DESIGN GROUP MAKES NO REPRESENTATION OF THE EXISTENCE OR NONEXISTENCE OF UTILITIES. CONTRACTOR IS RESPONSIBLE FOR CALLING THE MONTANA UTILITY NOTIFICATION CENTER (U-DIG 1-800-551-8344) AT LEAST TWO BUSINESS DAYS PRIOR TO DIGGING.
3. EXCAVATION, TRENCHING, SHORING, AND SHIELDING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING THE WORK, THESE DRAWINGS ARE NOT INTENDED TO PROVIDE MEANS OR METHODS OF CONSTRUCTION.
4. PRESERVE AND PROTECT ALL VEGETATION TO THE FULLEST EXTENT POSSIBLE.
5. METHODS FOR WORK AREA ISOLATION, FISH REMOVAL, AND EROSION CONTROL SHALL BE SUBMITTED TO RIVER DESIGN GROUP FOR APPROVAL PRIOR TO COMMENCING WORK.
6. THESE DRAWINGS AND THE ASSOCIATED WRITTEN SPECIFICATIONS REPRESENT THE CONSTRUCTION DOCUMENTS. ANY DEVIATIONS FROM THESE DRAWINGS AND ASSOCIATED SPECIFICATIONS WITHOUT WRITTEN APPROVAL FROM RIVER DESIGN GROUP, INC. MAY RESULT IN NOT MEETING CONTRACT DOCUMENTS AND MAY RESULT IN NOT BEING ACCEPTED FOR PAYMENT.

DRAWING INDEX

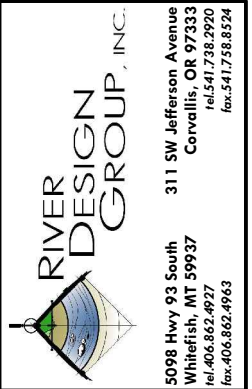
TL-1 COVER PAGE AND NOTES
PP-1 DESIGN PLAN AND PROFILE
TC-1 TYPICAL CROSS SECTION DIMENSIONS
DT-1 STRUCTURE LAYOUT
DT-2 SOD MAT BRUSH STRUCTURE DETAIL
DT-3 SMALL WOOD HABITAT STRUCTURE DETAIL
DT-4 LOG STEP POOL HABITAT STRUCTURE DETAIL

PROJECT VICINITY MAP



LEGAL DESCRIPTION

N¹₂ SECTION 10, T12N R10W, P.M., M. POWELL COUNTY, MONTANA.



Brazil Creek Phase 2 Restoration

TITLE SHEET

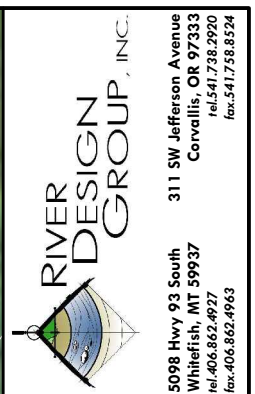
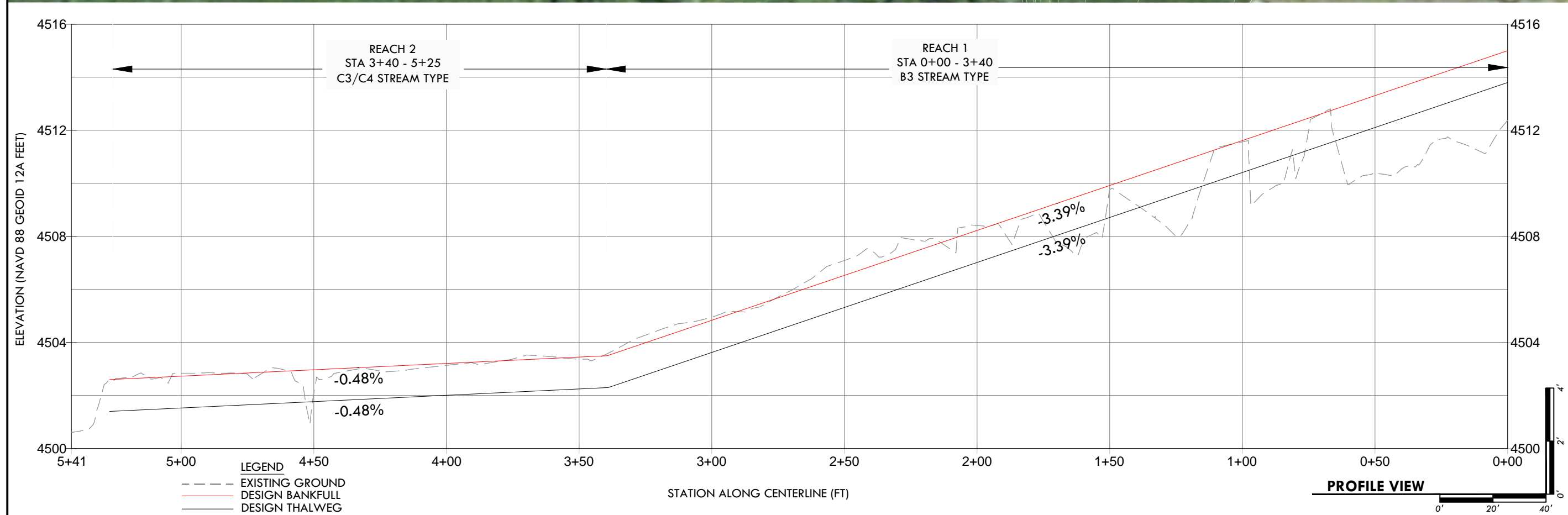
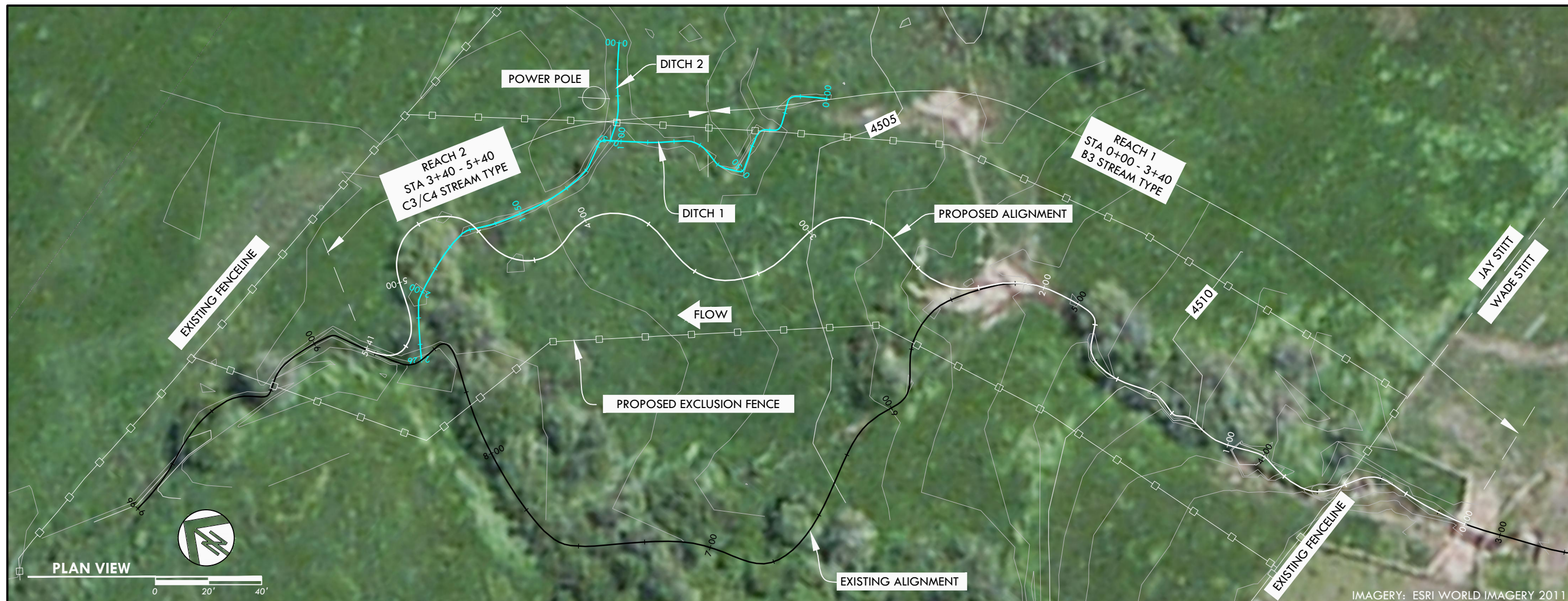
NO.	DATE	BY	DESCRIPTION	CHK
1	5-28-13	JL	50% Design	JM

preliminary
 -not for construction-

PROJECT NUMBER
RDG-13-035

SHEET NUMBER

TL-1

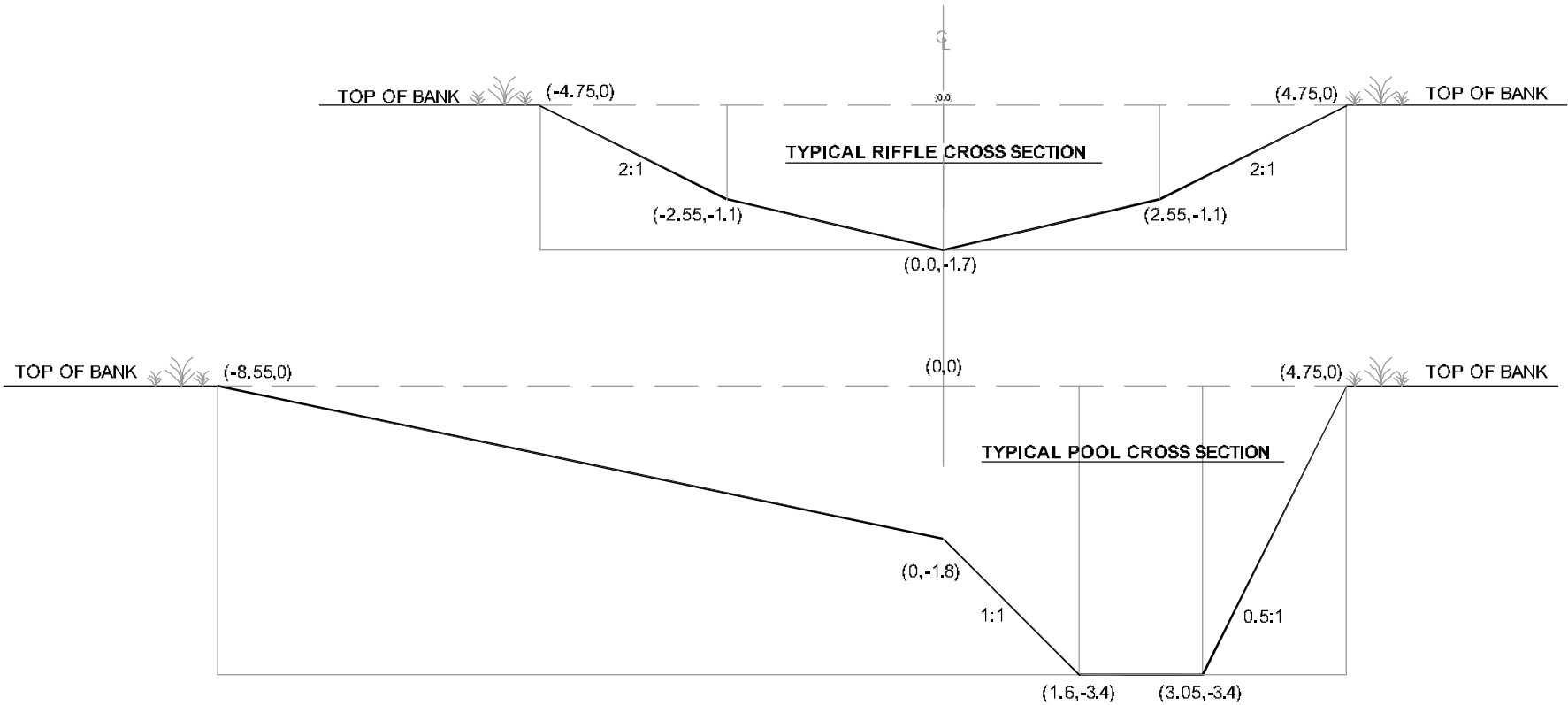


Brazil Creek Phase 2 Restoration

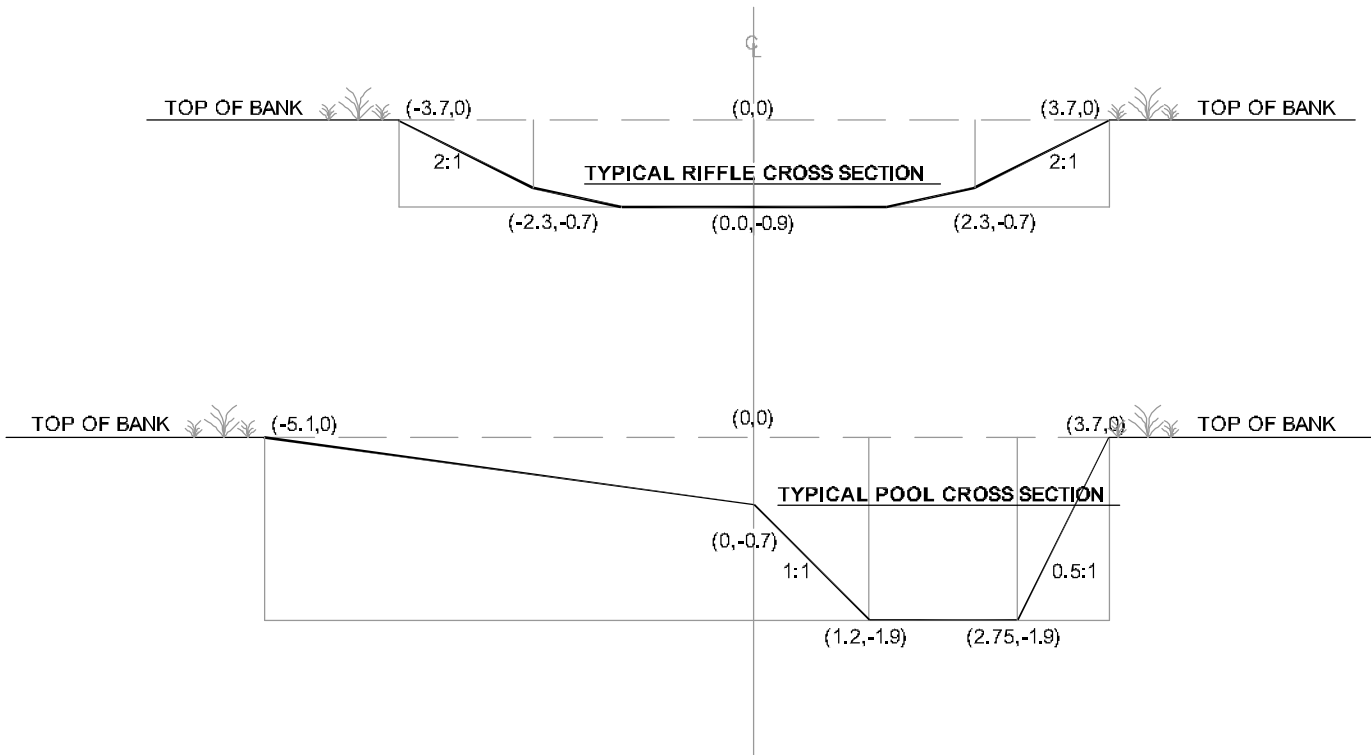
PLAN AND PROFILE

NO.	DATE	BY	DESCRIPTION	CHK
1	5-28-13	JL	50% Design	JM
PROJECT NUMBER RDG-13-035				
SHEET NUMBER PP-1				

NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK CENTERLINE

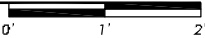


BANKFULL CHANNEL DESIGN DIMENSIONS C3 - C4 STREAM TYPE			
PARAMETER	FEATURE	RIFFLE	POOL
DISCHARGE		20 cfs	20 cfs
WIDTH		8.9-10.0 ft	12.3-14.2 ft
MEAN DEPTH		1.0-1.1 ft	1.7-1.9 ft
MAX DEPTH		1.6-1.9 ft	3.3-3.5 ft
SCOUR DEPTH		2.1 ft	4.2 ft
XS AREA		10 sq ft	24 sq ft
WIDTH:DEPTH		8-10	6-8



BANKFULL CHANNEL DESIGN DIMENSIONS B4 STREAM TYPE			
PARAMETER	FEATURE	RIFFLE	POOL
DISCHARGE		20 cfs	20 cfs
WIDTH		7.1-7.6 ft	8.1-9.6 ft
MEAN DEPTH		0.7 ft	0.7-0.8 ft
MAX DEPTH		0.9-1.0 ft	1.8-2.1 ft
SCOUR DEPTH		1.2 ft	2.3 ft
XS AREA		5 sq ft	6.5 sq ft
WIDTH:DEPTH		10-11	10-14

TYPICAL CHANNEL CROSS SECTIONS





RIVER
DESIGN
GROUP, INC.

3111 SW Jefferson Avenue
Corvallis, OR 97333
tel: 541.758.2929
fax: 541.758.8524

Braziel Creek Phase 2 Restoration

TYPICAL CROSS SECTIONS DIMENSIONS

NO.	DATE	BY	DESCRIPTION	CHK
1	5-28-13	JL	50% Design	JM

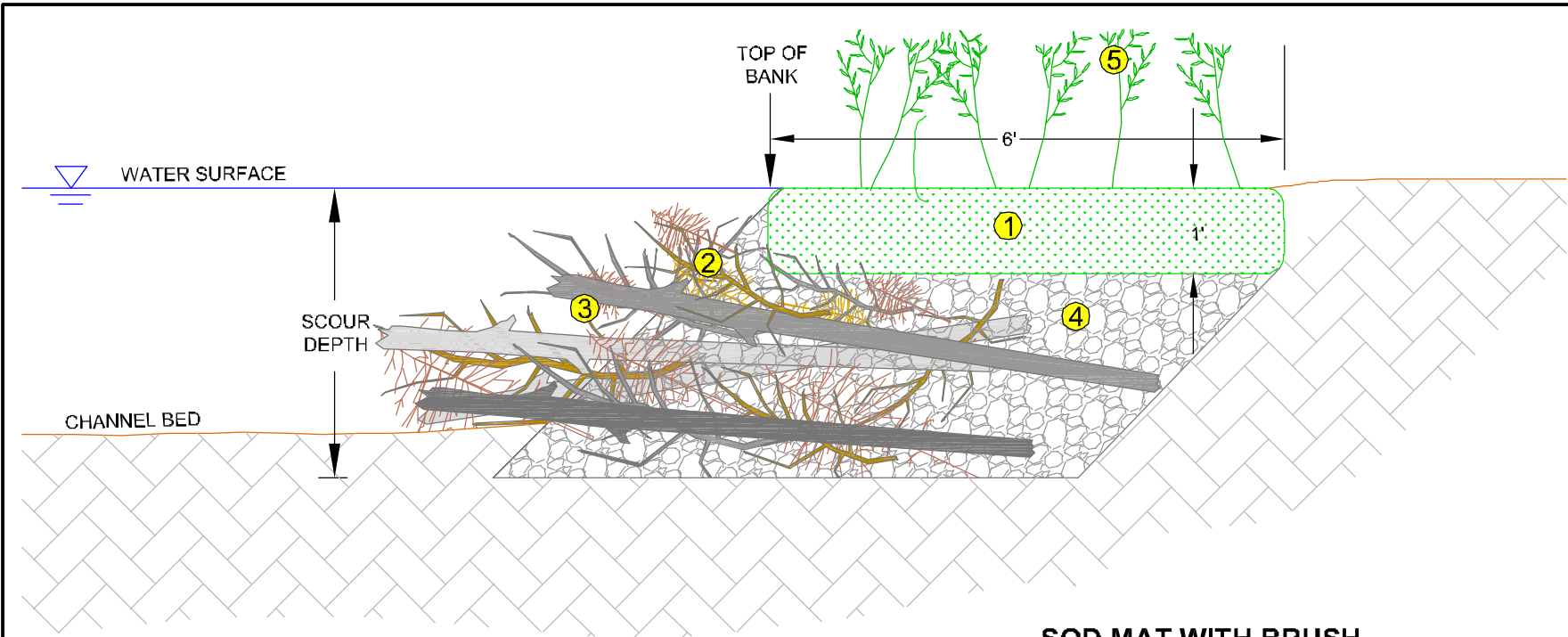
preliminary

-not for construction-

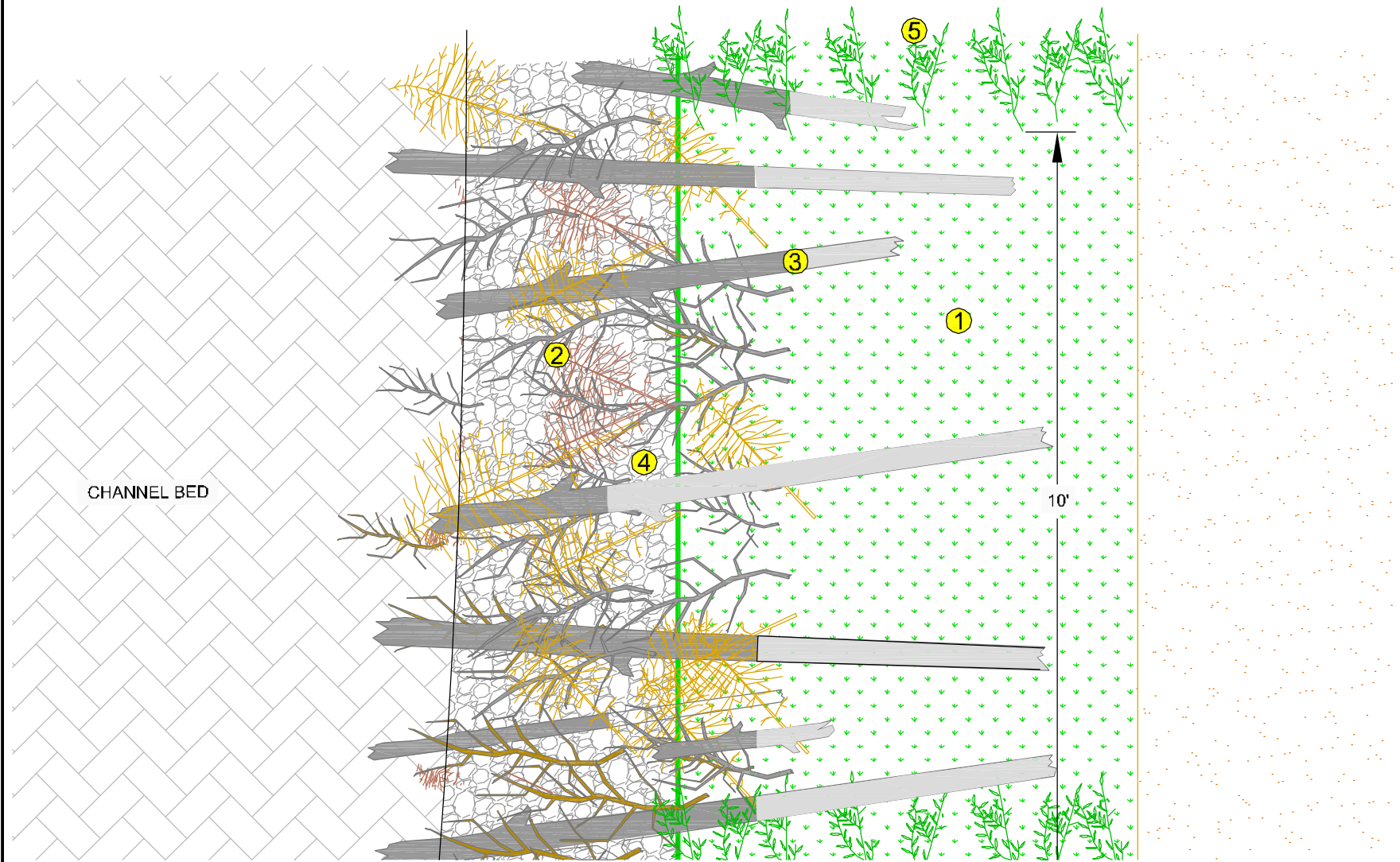
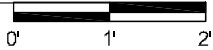
PROJECT NUMBER
RDG-13-035

SHEET NUMBER

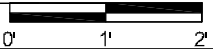
TC-1



SOD MAT WITH BRUSH
SECTION VIEW



SOD MAT WITH BRUSH
PLAN VIEW



DESIGN INTENT

THE INTENT OF THIS TREATMENT IS TO PROVIDE TEMPORARY BANK PROTECTION ALONG NEWLY CONSTRUCTED STREAMBANKS. THIS TREATMENT INCLUDES PLACEMENT OF WETLAND SOD MATS AND SMALL DIAMETER BRUSH INTERMIXED WITH WILLOW CUTTINGS TO PROVIDE STREAMBANK TOE PROTECTION AND HABITAT. WILLOW CUTTINGS ARE INTENDED TO PROVIDE SHADE, ROOTING STRENGTH AND COVER ALONG THE CHANNEL MARGINS. TYPICAL STRUCTURE PLACEMENT IS ALONG STRAIGHT, LOWER STRESS MARGINS OF THE NEW CHANNEL.

CONSTRUCTION NOTES

EXCAVATE TRENCH DOWN TO SPECIFIED DEPTH. PLACE AND STACK SOD AND BRUSH PIECES AS SHOWN. BACKFILL SOD AND BRUSH WITH 6-INCH PLUS ALLUVIUM.

MATERIAL SCHEDULE (PER LINEAL FOOT)

ITEM	QUANTITY	DIA. (IN)	LENGTH (FT)
1 SOD MAT	6 SF	6-12 (THICK)	3 X 6
2 BRUSH	1.0	3-6	5 - 10
3 SMALL LOGS	0.4	<6	5 - 10
4 CY OF NATIVE ALLUVIUM	0.2		
5 WILLOW CUTTINGS	10	0.25	6



EXAMPLE OF A CONSTRUCTED SOD MAT BRUSH BANK

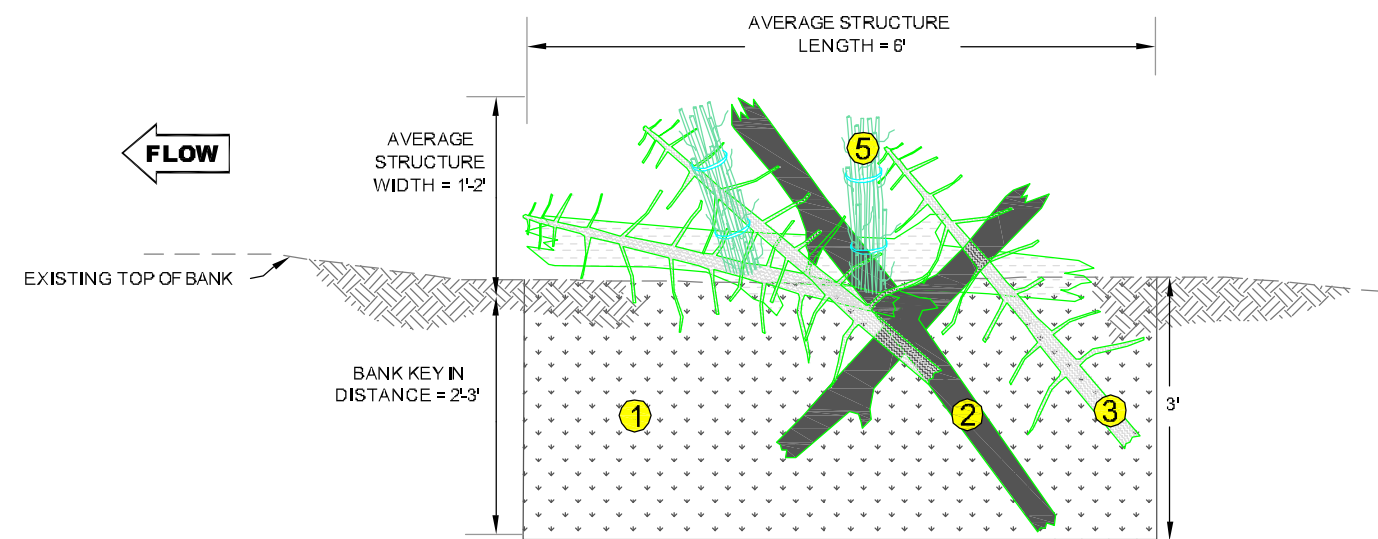
Braziel Creek Phase 2 Restoration
SOD MAT BRUSH BANK STRUCTURE

NO.	DATE	BY	DESCRIPTION	CHK
1	5-28-13	JL	50% Design	JM
			preliminary	
			-not for construction-	

PROJECT NUMBER
RDG-13-035

SHEET NUMBER

DT-2



NOTE:
BACKFILL WITH NATIVE MATERIAL
AND TRANSPLANT VEGETATION

SMALL WOOD HABITAT STRUCTURE
TYPICAL PLAN VIEW NTS

MATERIAL SCHEDULE (PER LINEAL FOOT)

	ITEM	QUANTITY	DIA. (IN)	LENGTH (FT)
①	SOD MAT	6 SF	6-12 (THICK)	3 X 6
②	SINGLE WOOD STEM	2	2 - 6	3 - 4
③	SMALL DIAMETER LIMBS	4	<2	3 - 4
④	CY OF NATIVE ALLUVIUM	0.4		
⑤	WILLOW FASCINE	10	0.25	6

DESIGN INTENT

THE SMALL WOOD HABITAT STRUCTURE IS INTENDED TO ENHANCE BOTH AQUATIC AND RIPARIAN HABITAT BY PROMOTING SCOUR POOL FORMATION, PROVIDING INTERSTITIAL REFUGIA AREAS, AND MODERATING WATER VELOCITIES IN THE NEAR-BANK REGION OF THE CHANNEL. THE ENERGY DISSIPATION PROVIDED BY THE SMALL WOOD ENCOURAGES GRAVEL DEPOSITION IN THE POOL TAILOUT WHICH MAY INCREASE THE AVAILABILITY OF SUITABLE SPAWNING HABITAT IN O'DELL CREEK. THE LOWER VELOCITY SEAM ALONG THE BANK LINE ENCOURAGES FINE SEDIMENT DEPOSITION WHICH PROVIDES SUBSTRATE FOR WOODY AND HERBACEOUS RIPARIAN VEGETATION. THE STRUCTURE IS FULLY SUBMERGED AT ALL FLOW LEVELS.

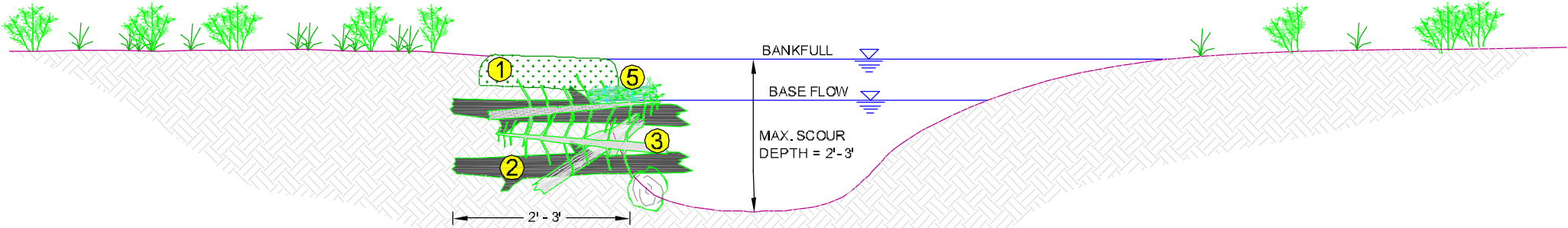
CONSTRUCTION NOTES

THE STRUCTURE SHALL CONSIST OF TWO TO THREE PIECES OF SMALL DIAMETER WOODY DEBRIS, INCLUDING STEMS RANGING FROM A MINIMUM OF 2-INCHES TO A MAXIMUM OF 6-INCHES IN DIAMETER, WITH INTACT LIMBS AND BRANCHES, NOT TO EXCEED 12-FEET IN LENGTH. SMALL WOOD FASCINES, WITH STEMS AND BRANCHES WITH A MAXIMUM DIAMETER OF 2-INCHES, MAY BE INCORPORATED IN THE STRUCTURE TO PROVIDE ADDITIONAL ROUGHNESS AND OVERHANGING COVER, AS DIRECTED BY THE CONSTRUCTION MANAGER. WILLOW FASCINES, BOTH BUNDLED AND LAYERED CUTTINGS, MAY BE INCORPORATED AS DIRECTED BY THE CONSTRUCTION MANAGER. THE STRUCTURES IS INSTALLED IN RUN AND POOL HABITAT UNITS.

THE EXCAVATOR SHALL INSTALL THE WOOD IN VARIOUS ORIENTATIONS TO FLOW, WITH NO GREATER THAN THREE FEET OF THE STEM PROJECTING INTO THE MAIN CHANNEL. THE REMAINDER OF THE STEM SHALL BE BURIED IN THE STREAMBANK. FOLLOWING INSTALLATION, WETLAND SOD SHALL BE PLACED ON THE CONSTRUCTED BANK.



CONSTRUCTED SMALL WOOD DEBRIS HABITAT STRUCTURE WITH
WOODY AND HERBACEOUS WETLAND VEGETATION SOD MAT



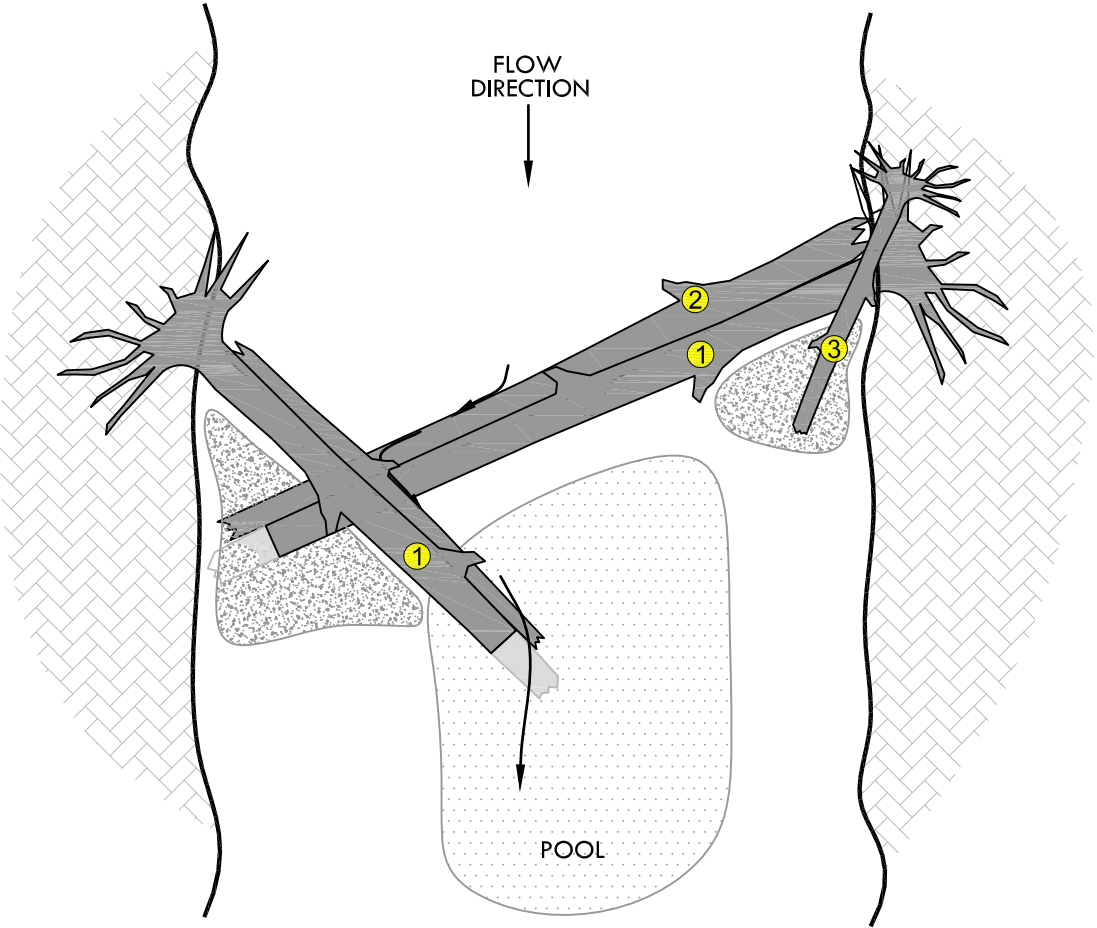
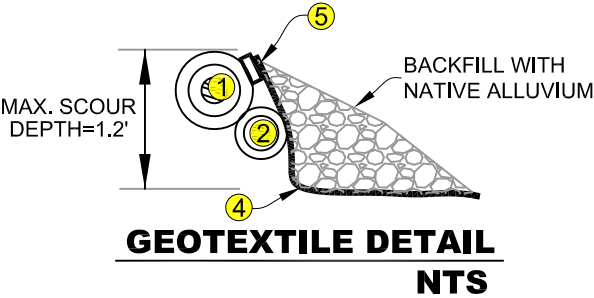
SMALL WOOD HABITAT STRUCTURE
TYPICAL CROSS SECTION NTS

DESIGN INTENT

THE INTENT OF THE CHANNEL SPANNING LOG HABITAT STRUCTURE IS TO CREATE AND MAINTAIN COMPLEX POOL HABITAT FEATURES AT A SPECIFIED SPACING BASED ON POOL FREQUENCY DATA COLLECTED ON STREAMS OF SIMILAR MORPHOLOGY. THE STRUCTURE IS DESIGNED TO MIMIC NATURAL FEATURES AND TO ALLOW FISH PASSAGE AT ALL FLOW LEVELS. THE STRUCTURE DISSIPATES ENERGY IN THE FORM OF A DOWNSTREAM SCOUR POOL AND MAINTAINS VERTICAL CHANNEL STABILITY. VARIOUS STRUCTURE ORIENTATIONS CAN BE CONSTRUCTED BASED ON THE LOCATION OF THE STRUCTURE RELATIVE TO THE CHANNEL PLANFORM AND LONGITUDINAL CHANNEL PROFILE.

MATERIAL SCHEDULE (PER STRUCTURE)

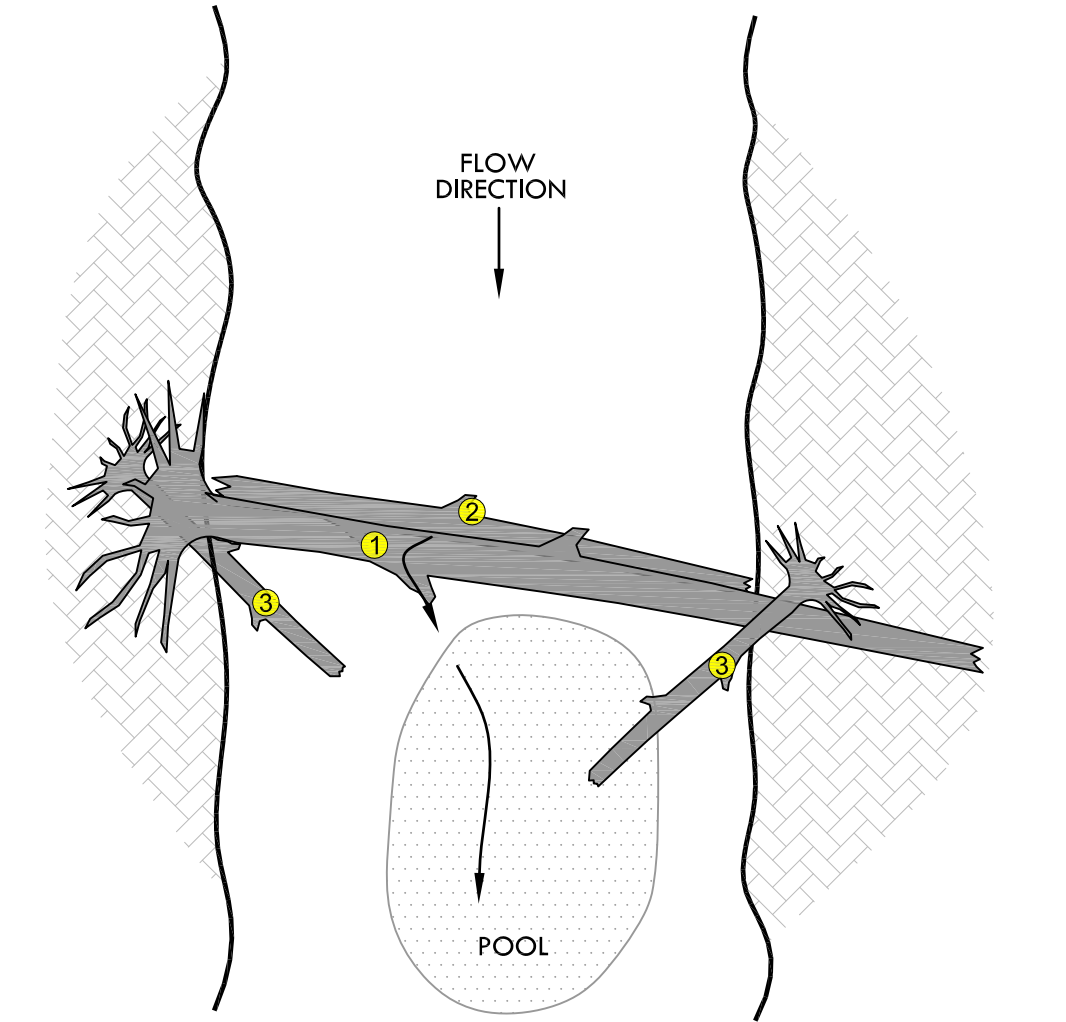
Item	Quantity	Dia. (in)	Length (ft)	Rootwad (Y/N)
1 Vane Log	1 - 2	10 -14	12 min.	Yes - 4 ft min.
2 Backer Log	1 - 2	8 - 10	12 min.	No
3 Habitat Log	2	8 - 10	12 min.	Optional
4 LF of Amoco 4553 8-oz. Filter Fabric	10 - 20		12.5 x 360 - Roll	
5 Ring Shank Nails	40 - 80	3/8	0.5	



EXAMPLE OF A CONSTRUCTED CHANNEL SPANNING LOG HABITAT STRUCTURE



EXAMPLE OF A CONSTRUCTED CHANNEL SPANNING LOG HABITAT STRUCTURE



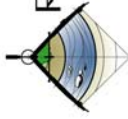
TYPICAL CHANNEL SPANNING LOG HABITAT STRUCTURE NTS

Brazil Creek Phase 2 Restoration
CHANNEL SPANNING LOG
HABITAT STRUCTURE

NO.	DATE	BY	DESCRIPTION	CHK
1	5-28-13	JL	50% Design	JM
			preliminary	
			-not for construction-	

PROJECT NUMBER
RDG-13-035

SHEET NUMBER
DT-4



RIVER
DESIGN
GROUP, INC.

5098 Hwy 93 South
Whitefish, MT 59937
Tel: 406.862.4927
Fax: 406.862.4963

311 SW Jefferson Avenue
Corvallis, OR 97333
Tel: 541.758.8920
Fax: 541.758.8524